
QPC449 Loop Signaling Trunk Card

Introduction

The QPC449 Loop Signaling Trunk Card is a peripheral equipment (PE) device that can be installed in any peripheral shelf or NT8D13 Peripheral Equipment (PE) Module. The loop signaling trunk card interfaces four analog trunk lines to the Meridian 1 switch. Each trunk is independently configurable using the Trunk Administration program (LD 14).

The loop signaling trunk card complies with Electronic Industries Association (EIA) transmission standards except for its terminating impedance and balancing network. Each of the four trunk interface units can interface with any of the following trunk types:

- Direct Inward Dial (DID) and Direct Outward Dial (DOD)
- Loop Dial Repeating (LDR) tie trunk
- Two-way Outgoing Automatic Incoming Dial (OAID) tie trunk
- Outgoing Automatic Number Identification (OANI)

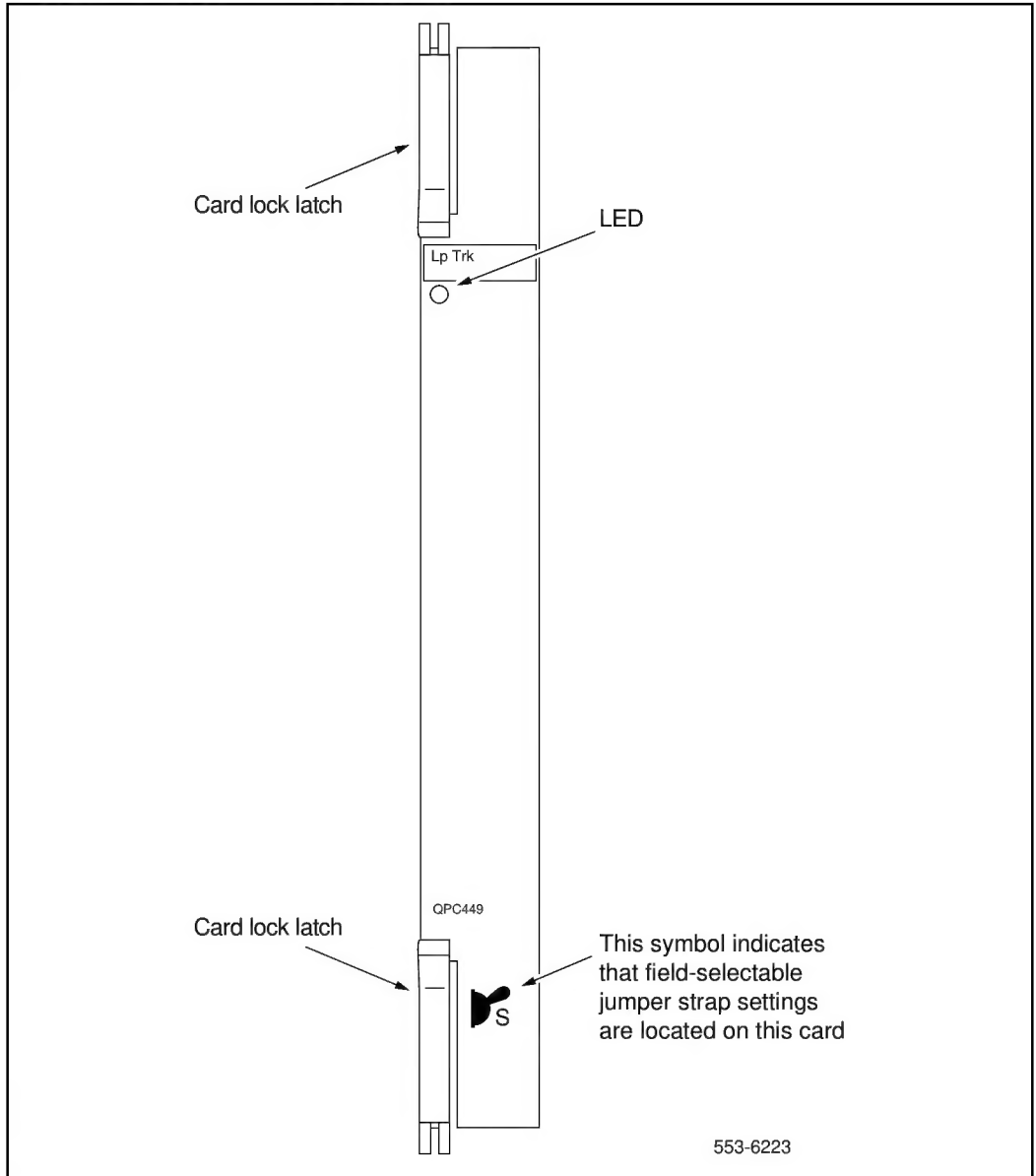
Physical description

The loop signaling trunk card mounts in any PE slot. The four trunk circuits and common multiplexing circuitry are mounted on a 31.74 cm by 25.4 cm (12.5 in. by 10 in.) printed circuit board.

The loop signaling trunk card connects to the backplane through an 80-pin connector shroud. The backplane is then cabled to the input/output (I/O) panel, which is cabled to the main distribution frame (MDF) by 25-pin cables. Trunk lines connect to the card at the MDF. See *Meridian 1 system installation procedures* (553-3001-210) for termination and cross connect information.

The faceplate of the card is equipped with a red light emitting diode (LED) (see [Figure 97](#)). The LED should only be lit if there is a problem with the card. If the LED operates in any other manner, such as continually flashing or remaining weakly lit, the card should be replaced.

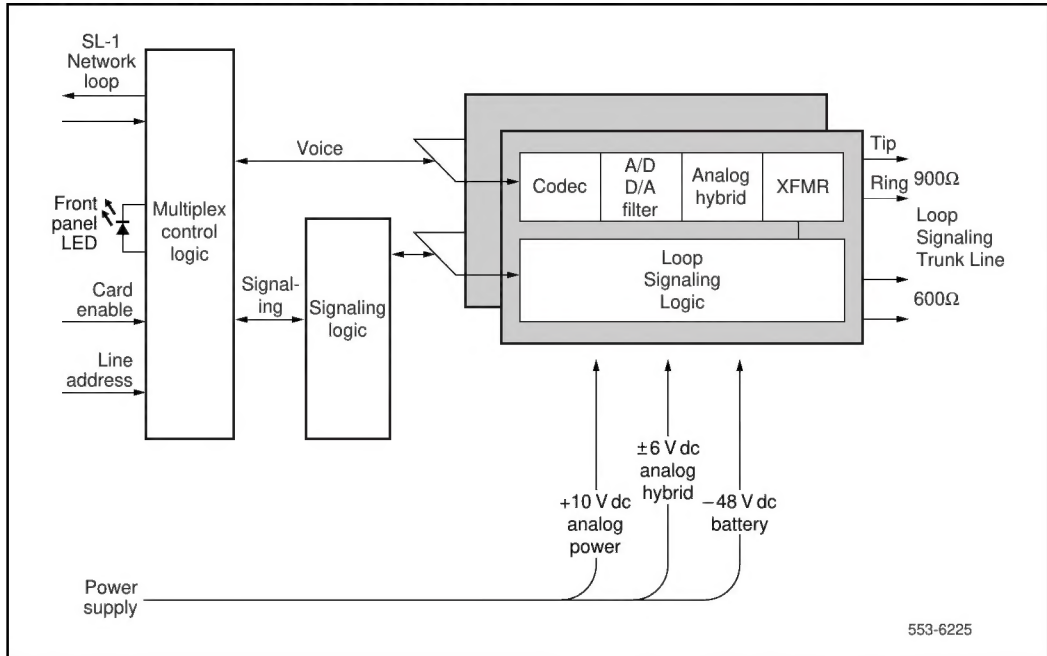
Figure 97
Loop signaling trunk card—faceplate



Functional description

Figure 98 shows a block diagram of the major functions contained on the loop signaling trunk card. Each of these functions is described on the following pages.

Figure 98
Loop signaling trunk card—block diagram



Card interfaces

The loop signaling trunk card passes both voice and signaling data over the network loop. Network loops are discussed in detail in “Peripheral equipment” on page 22.

Trunk interface units

The loop signaling trunk card contains four identical and independently configurable trunk interface units (also referred to as circuits). Each unit provides impedance matching and a balance network in a signal transformer/analog hybrid circuit. Also provided are relays for placing outgoing call signaling onto the trunk. Signal detection circuits monitor incoming call signaling.

Four codecs are provided for performing A/D and D/A conversion of trunk analog voiceband signals to digital PCM signals. Each codec supports one trunk interface unit.

Audio signals received from the tip and ring leads are fed to the analog-to-digital filter through the hybrid transformer. The receiver filter with some external components forms a 26 dB, 60 Hz rejection filter.

The filter limits the frequency range to a nominal 200 to 3400 Hz bandwidth and amplifies the signal for application to the codec. The codec encodes the analog signal to produce a digital signal that is applied to the common multiplexing circuit.

Digital signals from the multiplexing circuit are fed to the codec and decoded to produce an analog output. This is fed to the transmit filter, which amplifies and filters the resulting signal. This signal is then fed to the tip and ring leads through the hybrid transformer.

Multiplex control

The multiplex control logic is common to both channels. This logic interfaces the individual line circuits to the peripheral bus signaling channel. Circuits are provided in the multiplex control logic to retiming the digital signals received from the peripheral bus. Other circuits decode the address information contained on the peripheral bus to enable the individual trunk circuits during their selected time slots. Logic is also provided to enable or disable the front panel LED to indicate the service state of the card. The multiplex control logic is discussed in detail in “Peripheral equipment” on page 22.

Operation

The QPC449 Loop Signaling Trunk Card interface units are compatible with the equipment listed in [Table 63](#). Optional applications (such as class of service, signaling, and start arrangements) for each trunk are assigned in the Trunk Administration program (LD 14).

Battery and ground pulsing is provided for DID/DOD trunks and LDR tie trunks with a loop resistance of 445 to 1225 ohms in each conductor. For DID/DOD trunks, a loop range of 1600 ohms ensures a minimum loop current of 16.2 mA. For two-way OAID tie trunks, a loop range of 1000 ohms ensures a minimum loop current of 23 mA.

Table 63
Application and compatibilities

Application	Loop range (see note)	Compatible with
DID trunk	1600 Ω	Step-by-step CO interconnect; No. 5 crossbar outgoing trunk; sender trunk
DID/DOD trunk	1600 Ω	two-way tie trunk
LDR tie trunk		Pulse QPJ76 circuit; back-to-back with another signaling trunk
Two-way OAID tie trunk	1000 Ω	two-way tie trunk
OANI trunk		Centralized Automatic Message Accounting (CAMA) trunks
Note: The quoted loop range assumes a near end, far end battery of -42.75 V to -52.5 V and a ground potential difference of $\pm 10\text{ V}$.		

DID trunk

Release control of a call is specified in the system memory by the Trunk Route Administration program (LD 16). The two options available are EITHER or ORIGINATING party control. These can be specified for the Meridian 1 end (near end), or for the CO or other PBX end (far end). Joint party control can be specified for the far end.

The following description of signaling and supervision applies specifically to an EITHER party release arrangement for a call along a DID trunk and an ORIGINATING party arrangement along a tie trunk. This is the default condition if no options are specified in LD 16.

Origination at CO

- 1 A low resistance is placed at the CO between tip and ring.
- 2 The CPU in the Meridian 1 common equipment (CE) scans the signaling logic and receives a message that the trunk is off hook.
- 3 The CO applies battery-ground or loop pulsing dial pulses to the trunk.
- 4 The dial pulses are detected by the CE, which alerts the terminating station; a ringback tone is returned to the CO subscriber.
- 5 The terminating station lifts the receiver. A ringback tone is tripped.
- 6 Control message from CE operates relays K1, K2, and K3 (see [Figure 98](#)).
- 7 Reversed battery and ground are sent to the CO.

Termination from CO

- 1 The CO removes the low-resistance loop.
- 2 The CE detects changes and generates a signal to restore relays K1, K2, and K3.

Termination from near end

- 1 The station goes on hook.
- 2 The CE restores relays K1, K2, and K3.
- 3 The CO removes the low-resistance loop from the circuit.

Loop Dial Repeating tie trunk

Outgoing call

Origination of outgoing call

- 1** The station or console dials the trunk access code.
- 2** The CE seizes the trunk by sending a message to the signaling logic to open relays K1 and K2 (see Figure 98 on page 242).
- 3** A low resistance is applied between tip and ring.
- 4** When the trunk is ready for outpulsing, the CE operates K3 and digits are outpulsed by K2 under control of the signals on the data output bus.
- 5** At the end of outpulsing, K3 is released and control of K1 and K2 is returned to the signaling logic.
- 6** If answer supervision is provided by the far end, a reverse battery is applied between tip and ring when the far end answers.
- 7** The reverse battery is detected and monitored by the reverse battery detector network.

Termination of call

- 1** Trunk is arranged for outgoing party control.
- 2** The near end goes on hook with no answer supervision from the far end; K1 and K2 release together.

or

The near end goes on hook with answer supervision from the far end; K2 releases but K1 stays operated for 60 s if answer supervision is still being provided by the far end. Otherwise, K1 will release as soon as answer supervision ceases.

Incoming call**Origination of call**

- 1 The far end initiates a call by placing low resistance between tip and ring, causing battery current to flow.
- 2 Loop current flow causes a signal on the data input bus to the CE.
- 3 Dial pulses are applied from the far end in the form of battery/ground or loop current.
- 4 CE detects dial pulses as changes in state on the data input bus.
- 5 The terminating party answers, operating K1, K2, and K3.
- 6 Reverse battery and ground are sent to the far end.

Termination of call

- 1 The far end releases.
- 2 The far end removes low-resistance loop.
- 3 CE detects a change in resistance and releases K1, K2, and K3, restoring normal battery and ground.

OAID tie trunk**Outgoing call****Origination of call**

- 1 The originating party dials the access code.
- 2 CE seizes the trunk by operating relays K1, K2, and K3 (see [Figure 98](#)).
- 3 The battery is placed on tip and ground on ring, alerting the far end.
- 4 The far end answers the call, causing a low resistance to be placed between tip and ring.
- 5 The loop current detector at the near end monitors loop current flow.

Termination of call

- 1 The trunk is arranged for originating party (near end) control.
- 2 If the near end releases, CE releases K1, K2, and K3, restoring normal battery.

 If the far end releases, the low-resistance loop is removed from tip and ring.
- 3 Current detector informs CE of zero loop current flow.
- 4 CE releases K1, K2, and K3, restoring normal battery and ground.

Incoming call

Origination of call

- 1 The far end places low-resistance loop between tip and ring.
- 2 The loop current detector at the near end detects loop current and signals the CE.
- 3 The far end sends dial pulses by interrupting loop current.
- 4 The near end answers the call, completing the circuit. If answer supervision is required, reverse battery is sent on tip and ring.

Termination of call

- 1 The trunk is arranged for originating party (far end) control.
- 2 The far end removes low-resistance loop.
- 3 The current detector informs CE of zero current flow.
- 4 CE restores normal battery and ground.

Senderized operation for DID and LDR trunks

If the far end is senderized, the Meridian 1 can be operated in any mode: immediate start (IMM), delay dial (DDL), or wink (WNK) start, as assigned on a class of service basis.

For immediate start, following the seizure signal, the far end may start pulsing after the standard delay (normally 70 ms minimum) controlled by the distant end. For stop/go signaling, following the seizure signal, an off hook/on hook (320 ± 64 ms for DDL, 256 ms for WNK) signal will be returned almost immediately to the distant end to satisfy DDL or WNK mode. The distant end detecting this signal may start pulsing after the standard delay (normally 70 ms minimum) controlled by the distant end.

When DDL or WNK class of service is used, outgoing calls require a stop/go signal from the far end so that the trunk cannot outpulse.

Electrical specifications

This section gives the electrical specifications for the loop signaling trunk card.

Trunk interface electrical characteristics

Table 64 gives the electrical characteristics for the trunk interface units on the loop signaling trunk card.

Table 64
Electrical characteristics

Characteristics	Description
Circuits per card	4
Options	600 or 900 Ω nominal impedance, selected at main distribution frame (MDF)
Loop termination	270 Ω
Effective gain	1.0 dB line-to-trunk
	1.0 dB trunk-to-trunk
Line leakage	>30 k Ω
Power feed	165/165 Ω balanced, 48 V nominal
External resistance	2000 Ω max (for 16.2 mA)
Ground potential difference	± 10 V dc max
Far-end battery limits	-42.75 to -52.5 V dc
Card options	600/900 Ω nominal impedance; ANI or non-ANI; loop or battery/ground pulsing on ANI

Overload level

Signals exceeding +7 dBm applied to the tip and ring terminals will cause distortion in the signal.

Power requirements

[Table 65](#) lists the power requirements for the loop signaling trunk card.

Table 65
Power requirements

Voltage	Tolerance	Worst case current
+6.0 V dc	± 5 %	80 mA
−6.0 V dc	± 5 %	80 mA
+10.0 V dc	± 2%	10 mA
−48 V dc	± 10%	300 mA
−52 V dc	± 10%	160 mA
+2.5 V Ref	± 0.5%	< 0.1 mA

Foreign and surge voltage protections

When telephone lines connected to the trunk circuit are exposed to foreign voltages by direct contact or induction (e.g., power line crosses or lightning), protection devices must be installed on the customer's premises. These devices must be capable of providing a path to ground from tip and ring for foreign voltages that exceed 600 V peak.

Environmental specifications

[Table 66](#) lists the environmental specifications for the loop signaling trunk card.

Table 66
Environmental specifications

Parameter	Specifications
Operating temperature	0° to +60° C (+32 to +140° F), ambient
Operating humidity	5 to 95% RH (noncondensing)
Storage temperature	−40° to +70° C (−40° to +158° F)

Connector pin assignments

The loop signaling trunk card brings the analog trunks to the PE backplane through an 80-pin connector shroud. The backplane is cabled to the input/output (I/O) panel on the rear of the module, which is then connected to the main distribution frame (MDF) by 25-pair cables.

Telephone trunks connect to the loop signaling trunk card at the MDF using a wiring plan similar to that used for line cards. A typical connection example is shown in [Figure 99](#), and a list of the connections to the loop signaling trunk card is shown in [Table 67](#). See *Meridian 1 system installation procedures* (553-3001-210) for complete I/O panel connector information and wire assignments for each tip/ring pair.

Figure 99
Loop signaling trunk card—typical cross connection example

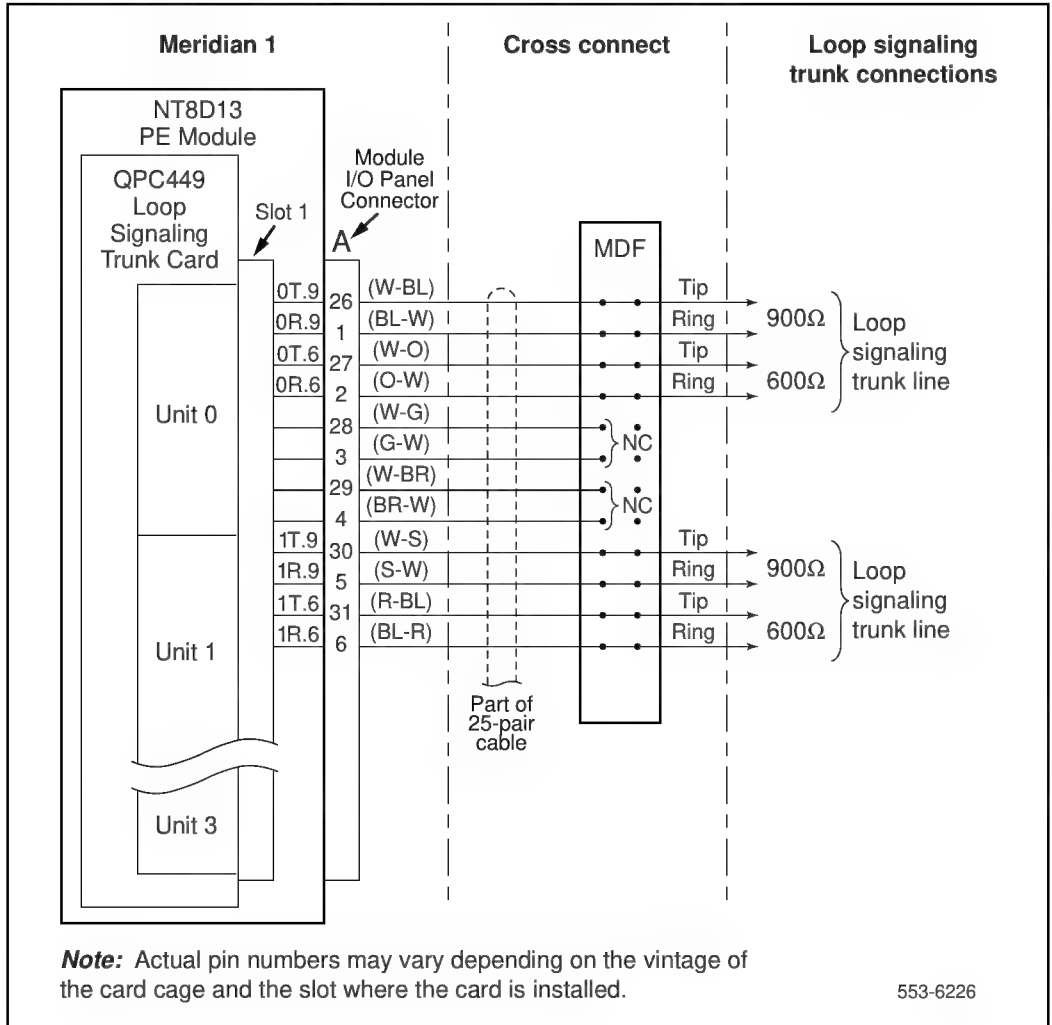


Table 67
Loop signaling trunk card—backplane pinouts

Connector Pin	Signal	Unit
36A	Tip, 900Ω	0
37A	Ring, 900Ω	
38A	Tip, 600Ω	
39A	Ring, 600Ω	
29A	Tip, 900Ω	1
30A	Ring, 900Ω	
31A	Tip, 600Ω	
32A	Ring, 600Ω	
2A	Tip, 900Ω	2
3A	Ring, 900Ω	
4A	Tip, 600Ω	
5A	Ring, 600Ω	
9A	Tip, 900Ω	3
10A	Ring, 900Ω	
11A	Tip, 600Ω	
12A	Ring, 600Ω	

Configuration

This section gives information on configuring the loop signaling trunk card.

Switch and jumper settings

The trunk type for each unit on the card is selected by software service change entries at the system terminal. There are no switches or jumpers on the loop signaling trunk card. An outline of the card is shown in [Figure 100](#).

Service change entries

The trunk type, features, signaling arrangement, and transmission properties for each trunk are selected by making service change entries in the Trunk Administration program (LD 14). Refer to the *Meridian 1 X11 input/output guide* for LD 14 service change instructions.

Insertion loss

The transmission properties of each trunk are characterized by class of service (COS) assignments in the Trunk Administration program (LD 14). The assignments can be either:

- Via Net Loss (VNL)
- non-VNL, either transmission compensated (TRC) or Non-Transmission Compensated (NTC)

To ensure stability and minimize echo when connecting to long-haul VNL class of service trunks, these non-VNL trunks are assigned either TRC or NTC class of service. TRC and NTC determine the operation of the switchable pads contained in the trunk cards. They are assigned as follows:

- TRC: for a 2-wire non-VNL trunk facility with a loss of greater than 2 dB or for which impedance compensation is provided; or for a 4-wire non-VNL facility
- NTC: for a 2-wire, non-VNL trunk facility with a loss of less than 2 dB or when impedance compensation is not provided

The control pad switching for the various through connections and the actual loss introduced are given in [Figure 101](#). The pad switching algorithms are used to provide proper insertion loss and echo protection when required.

Figure 100
Loop signaling trunk card—switches and jumpers

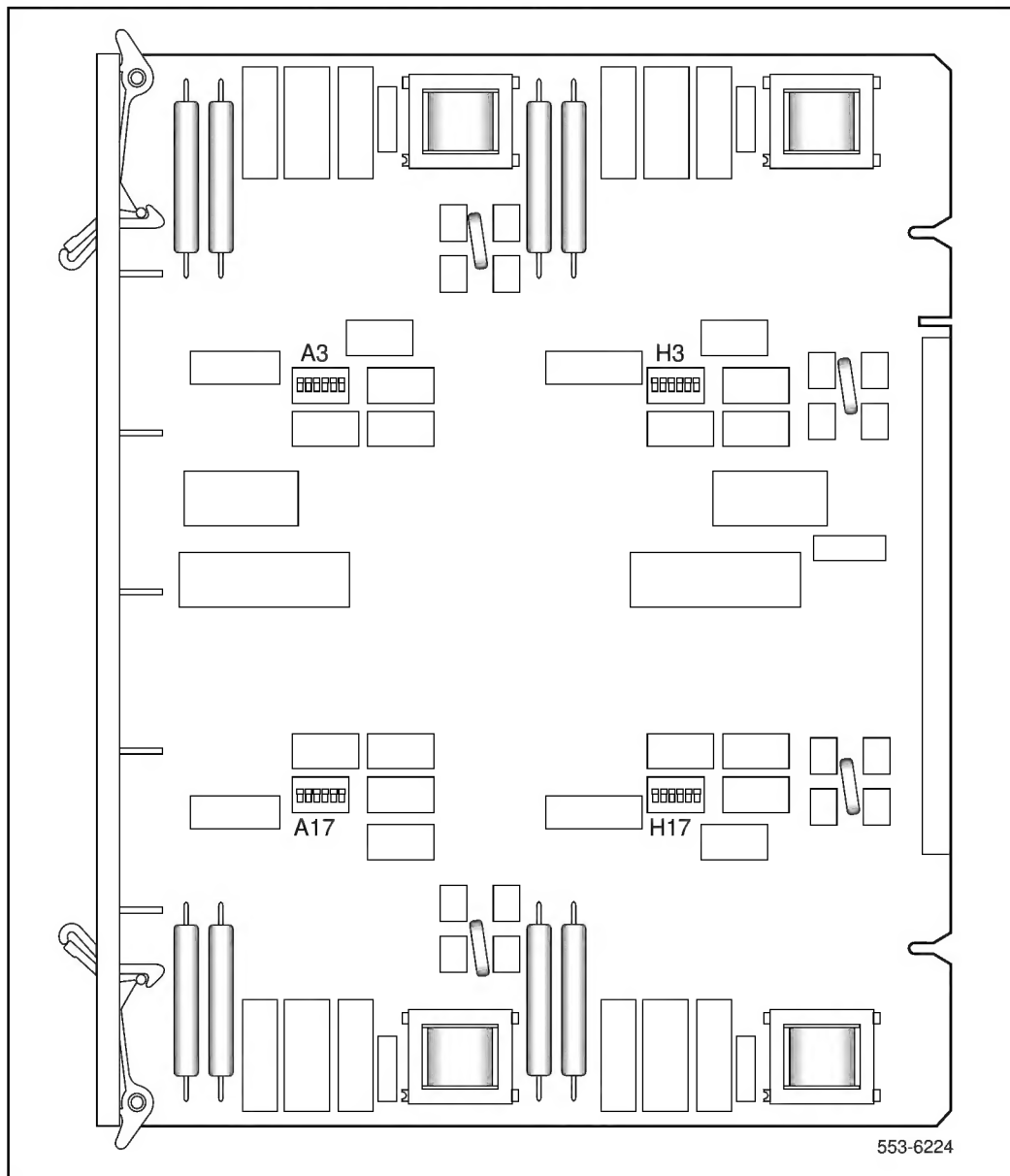


Figure 101
Pad switching algorithms

Through connection				Terminal balance				Through balance
To From Legend IN Pad switched IN OUT Pad switched OUT NA Not applicable				Station lines Attendant lines		Non-VNL		VNL
						Non-transmission compensated (2 wire facility loss <2 dB or not impedance compensated)	Transmission compensated (2-wire facility loss >2 dB or impedance compensated or 4-wire facility)	4-wire
						Tie	CO/FX/WATS & CCSA	QPC71 or equivalent
Station lines Attendant lines				NA	OUT	OUT	OUT	IN
				(5)	(1)	(1)	(1)	(3)
				NA	NA	NA	NA	NA
Terminal balance	Non-VNL	Non-transmission compensated (2 wire facility loss <2 dB or not impedance compensated)	CO/FX/WATS & CCSA	NA	OUT	IN	OUT	IN
			Tie	(1)	(1)	(1)	(1)	(3)
		Transmission compensated (2 wire facility loss <2 dB or impedance compensated or 4-wire facility)	CO/FX/WATS & CCSA	OUT	IN	OUT	OUT	IN
			Tie	(1)	(1)	(1)	(1)	(1)
	VNL	4-wire	CO/FX/WATS & CCSA	OUT	IN	OUT	IN	OUT
			Tie	(1)	(1)	(1)	(1)	(1)
		4-wire	CO/FX/WATS & CCSA	OUT	IN	OUT	IN	IN
			Tie	(1)	(1)	(1)	(1)	(1)
Through balance	VNL	4-wire	QPC71 or equivalent	NA	IN	IN	IN	IN
				(3)	(1)	(3)	(1)	(1)

Note 1: Actual loss (dB) for each connection is given in parentheses.

Note 2: All trunks have an effective gain of 1.5 dB and contain 4 dB switchable pads.

Note 3: The Meridian 1 controls the overall connection to connection gain.

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